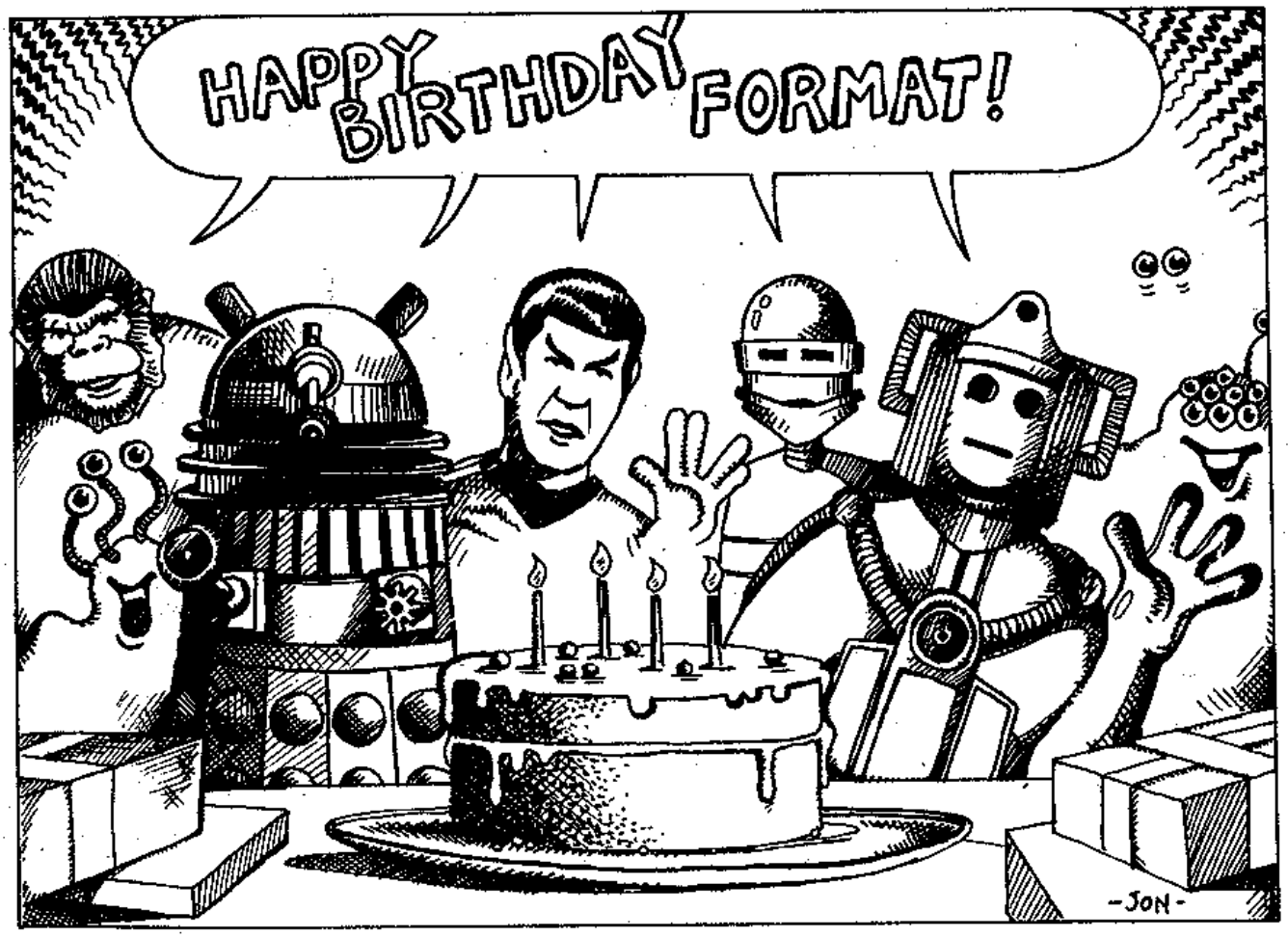
Vol.5 - Nº 1. September 1991.

FORMAT

FOR SPECTRUM AND SAM USERS



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NEWS ON 4

MUSIC WRITER GOES MIDI

The highly acclaimed MUSIC WRITER from Garry Rowland now has a MIDI extension and a compiler extension.

The MIDI extension allows users to play a score or bar of music through a MIDI instrument instead of the 128K's sound chip. The MIDI instrument can be connected either through the MIDI/RS232 port on the rear on the Spectrum or through a number of external interfaces including the RAM Music Machine currently being sold by Datel. The MIDI extension costs £10.50 including p&p.

The compiler extension allows music composed with MUSIC WRITER to be turned into a stand-alone routines that can be used in your own programs. The compiler only costs £4 (incl p&p) and comes complete with a PD program to demo how to use music in your own software. Contact G.Rowland, P.O.Box 49, Dagenham, RM9 5NY.

ANOTHER UPGRADE FROM LERM

LERM seem to produce more upgrades than any other company and every ones a winner. The latest is a new version of their SAMTAPE Spectrum emulator system. Version 4M now has extras for use by users of SAMCO's Messenger interface. SAMTAPE 4M costs £11.99 and as usual existing users have the option of very reasonable upgrades on return of their old disc. See LERM's advert in this issue.

NEW ONLINE SERVICE

Online Now Ltd. have launched a new on-line database. The service includes News, E-mail, Classified ads, Games, Auctions, Job file, Share information and lots more. All you need is a modem capable of 3/12/2400 BPS (even parity, 7 bits, 1 stop bit) There are no membership fees but you do pay the 45p (34p cheap rate) per minute telephone charges of BT.

Online can be dialed on 0839-669966.

ANOTHER CONSOL DISASTER

Commodore UK have admitted that sales of their C64GS consol system have been disastrous. In an interview given to the Independent On Sunday newspaper Steve Franklin, managing director of Commodore's UK operation, said that only 15,000 of their much advertised consols had been sold.

Hot on the heels of the poor sales of the Amstrad consol this leaves Sega and Nintendo way out in front. Could it be though that users are beginning to see the benefits that a real computer has over a games consol?

NEW ADVENTURE CLUB

After a long, and somewhat chequered career the Adventure Club Ltd has finally closed for good. However a group of ex-members and reviewers have joined forces to launch the Adventure and Stategy Club and have taken over printing updates to the Reference Book of Adventure on a bi-monthly basis.

The emphasis of the club is multi format although there is a significant Spectrum presence.

Membership costs £24 per year for UK. Write to Hazel Miller, 17 Sheridan Road, Manor Park, London. E12 6QT.

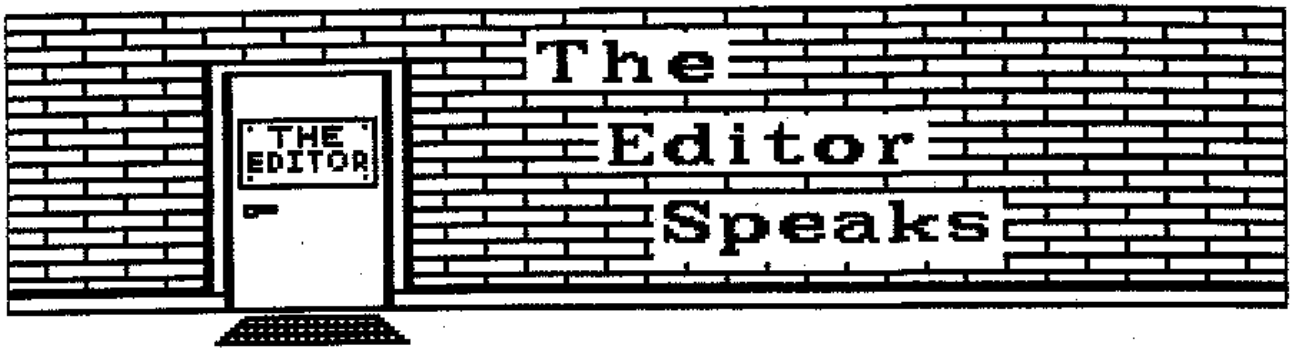
SHOW CLOSED TO PUBLIC

EMAP, the organizers of the European Computer Trade Show, have shocked the industry by closing the show to members of the public.

Last years show attracted thousands of people and advance tickets had been advertised for some time. One hall at this years show was to have been trade only, but in an eleventh hour turn around EMAP Exhibitions announced that the whole show was to be trade only.

Show freaks need not despair though, the All Formats Shows 'now available at a venue near you' should keep you all happy.

News Credits: Paul Turner, Bob Bates.



Here it is, the first issue of Volume 5. The years just seem to rush by don't they? I know I've said it before, but I'll still say it again - It seems only yesterday that I sat down to write the first editorial.

Well, FORMAT continues to go from strength to strength (unlike many of the other magazines on the market). Our readership continues to grow (more about that next month) and so does FORMAT. Each month we manage to pack in more real information on the Spectrum and SAM Coupé than all our rivals combined. We have managed a regular 40 pages for some months now and even larger issues are planned for the future, who knows what the next year will bring? 48 pages? 60 pages? We will just have to wait and see. With the support of our readers and the writers/ programmers who contribute to FORMAT we will carry on growing for a long time to come.

I have had several telephone calls recently asking about the availability (or lack of) books about the Z80 and Spectrum. At one time, around 1983/4, there was such a glut of books everyone was spoilt for choice. Now however there really are none left in print, so many new Spectrum (and indeed SAM) users are left out in the cold. Still I know that many readers will have books on their shelves gathering dust and no longer needed, so lets try to redistribute these sources of knowledge shall we?

The Small Ads section would be a good place if you want to sell the books but if you just want to get rid of them then I have another method for you. Simply box up the books (make sure they are in good condition) and send them to me at FORMAT. We will then run regular lists in FORMAT and, when space permits take some items to shows. The profits from any sales will be donated to charity. As well as books we will also accept software but items must beoriginals, complete with manuals etc, and of course fully working (please test before sending in).

Many readers with SAMs will have followed Carol Brooksbank's excellent series of articles in FORMAT under the title Money Manager. For me they did more to explain SAM Basic than anything else I have seen published. Some though, will not have had the guts and determination to type in the whole program. Well now there is no need to miss out on the program. FORMAT Publications have launched the program on disc, not only that but there is a version for the 128k Spectrum on the same disc. The 128k program works under Beta Basic and a run-time version is included so you don't need to buy Beta Basic as well (although that would be a step I would recommend to anyone who is interested in Basic programming).

The disc comes complete with a manual giving worked examples of how to use the program. Its retail price is £15.95 but INDUG members can obtain a copy for £12.95 through the FORMAT Readers Service page in this issue.

Finally, my thanks to all of you for reading FORMAT, and my special thanks to all who have taken the time to send us such nice letters. It gives us a great deal of pleasure to know that our efforts are appreciated.

Bob Brenchley. Editor.

a beautifully neat solution... this particular version is set up to work with the PLUS D drive, but I guess it could be modified for the Discovery, or even for cassettes.

Set up the Spectrum in 128K mode with DOS initialised and a nice new formatted disc waiting in the PLUS D. Type in the following program and save it to disc (use line 999).

```
  1 REM ***JOHN TAYLOR***
  2 REM ***SERIAL SETUP PROGRAM***
 10 INPUT "ENTER REQUIRED BAUD RATE "
    ;a
 20 FORMAT "p";a
 30 SAVE D*"PRBUFF" CODE 23296,255
 40 SAVE D*"RS232PCHN" CODE 23749,5
 50 CLS: PRINT "SETTINGS SAVED"
 60 PRINT #0;"PRESS ANY KEY TO RESET"
 70 PAUSE 0
 80 RANDOMIZE USR 0: REM USE ONLY THI
    S METHOD TO GET TO 48K MODE
999 SAVE D*"SERSETUP" LINE 10
```

Now type in the following program and save it to disc.

```
  1 REM ***JOHN TAYLOR***
  2 REM ***48KRS232***
 10 LOAD D*"PRBUFF" CODE
 20 LOAD D*"RS232PCHN" CODE
 30 PRINT "IMPORTANT - DON'T USE COPY
     COMMAND"
 40 REM BAUD RATE WILL BE SET TO "a"
    FROM FIRST PROGRAM
 50 REM NOW LOAD TASWORD 2, VU-FILE,
    ETC.,
 60 REM ALL OUTPUT WILL BE THROUGH RS
    232
 70 REM UNDER THESE CONDITIONS, COPY
    COMMAND CORRUPTS THE CODE IN THE
    PRINTER BUFFER AND WILL CAUSE A C
    RASH
999 SAVE D*"48KRS232" LINE 10
```

I haven't had a chance to test this useful program, so I will be interested in readers' reactions. John says he's working on variants which will enable one to switch between the "p" and "b" channels, and will send information shortly. We look forward to them, John.

Disaster strikes! In order to sort out these programs, I type on a grey Spectrum 128, linked to a Discovery disc system. This leaves the setup alongside; identical but for a PLUS D disc interface, free for testing things, as is SAM and the Spectrum +3. I've got a very nice little program here from John Redfern of Forest Hill, London. It's rather longer than usual; what it does is to convert Tasword 2 files to opentype files which just fit on the Spectrum screen. It also outputs to the printer. However, it all looks rather neat and tidy. Problem is, all of a sudden, all the port on my PLUS D will produce is garbage. So I can't run it as I like. However, it looks too good to leave to fester, so here it is, untried and untested. Hopefully, PLUS D will be rejuvenated for next month. I haven't included anything like this for a month or two: the whole thing is menu-driven rather nicely, though there's nothing particularly revolutionary in it.

To make a README file which will easily display to the screen, all you need to do is to type the stuff in to Tasword 2, setting the margins at 0 and 32. As John mentions, the problem is to find a way of getting his Basic program to locate the end of his file, otherwise the thing will run for ever, and you will get all sorts of interesting but unsolicited things on the screen (actually, it's quite entertaining doing it with a disc you haven't used for ages and ages, and on which all sorts of things have been saved and erased - you can find quite a range of interesting things in some of the sectors). Anyway, as John mentioned, he really didn't want to be troubled with this sort of thing at this stage, so he used the "tilde" sign as an end of file marker. So, when you have completed the text and are satisfied with it, go on the next clear line (this is important) and type a tilde sign (CHR$ 126): it's on extended mode, symbol shift and A. Then save your Tasword 2 file.

Meanwhile, you will, of course, have typed in the converter program called README. I liked this - nothing revolutionary, but easy to read and

understand, well laid out and it copes with single and twin disc systems. Nice example of Basic programming. Here it is...

```
 5 REM ******README******
10 REM ***John Redfern***
20 CLOSE #*: GOSUB 30: GOTO 40
30 CLS : PRINT  BRIGHT 1; INVERSE 1;
   AT 0,0;"    README FILE CREATOR v
   3.5    ": RETURN
40 PRINT AT 2,10;"-OPTIONS-"'" [1]-
   CONVERT TASWORD 2 FILE"'" [2]-SE
   LECT README FILE"'" [3]-DISPLAY
   README FILE"'" [4]-PRINT README
   FILE"
50 IF B$="" THEN PRINT '''"      No
   file selected": GOTO 70
60 PRINT '''"   File Selected:-"; IN
   VERSE 1;B$
70 PRINT AT 21,0;"DRIVE #";DR;" ACTI
   VE"
80 INPUT "SELECT OPTION ";A: PRINT A
   T 21,0;,,: IF A=1 THEN GOTO 140
90 IF A=2 THEN GOTO 340
100 IF A=3 THEN GOTO 460
110 IF A=4 THEN GOTO 550
120 GOTO 80
130 STOP
140 LET A$="": LET L=1
150 CLS : GOSUB 30: PRINT AT 10,2;"EN
    TER NAME OF TASWORD FILE ";AT 12,
    10;"TO CONVERT": INPUT T$: INPUT
    "Drive to LOAD from ";DR1
160 CLS : GOSUB 30: PRINT AT 10,1;"TA
    SWORD FILE'";T$;"'LOADED";AT 12,1
    0;"FROM DRIVE ";DR1
170 LOAD DDR1;T$CODE 32000
180 INPUT "ENTER FILENAME FOR SAVING:
    "'"(MAX 8 LETTERS): "; LINE C$: I
    NPUT "Drive to SAVE to ";DR2: IF
    LEN C$>8 THEN GOTO 180
190 CLS : GOSUB 30: PRINT AT 8,3;"Con
    verting 'Tasword2' file ";AT 10,1
    0;"'";T$;"'"
200 IF LEN C$<8 THEN LET C$=C$+"_": G
    OTO 200
210 IF DR1=DR2 THEN PRINT #0;"Ensure
    correct Disc in Drive    Then pre
    ss a Key": PAUSE 0
220 LET C$=C$+"_R": OPEN #4;DDR2;C$ O
    UT
230 LET N=32000
240 PRINT AT 13,6;"To 'OPENTYPE' FILE
    ";AT 15,10;"'";C$;"'"
250 LET M=PEEK N: IF M=126 THEN GOTO
    310
260 PRINT AT 18,12;N-32000;" Bytes"
270 LET A$=A$+CHR$ M
280 IF L=32 THEN PRINT #4;A$: LET A$=
    ""
290 IF L=64 THEN LET A$="": LET L=0
300 LET L=L+1: LET N=N+1: GOTO 250
310 CLOSE #*4
320 GOTO 20
330 STOP
340 LET B$=""
350 PRINT AT 19,0;"DRIVE #";DR;" ACTI
    VE"'"PRESS 1 OR 2 TO CHANGE"'"ENT
    ER TO CONTINUE"
360 PAUSE 0
370 IF INKEY$=CHR$ 13 THEN GOTO 410
380 IF INKEY$="1" THEN LET DR =1: GO
    TO 410
390 IF INKEY$= "2" THEN LET DR =2: GO
    TO 410
400 IF INKEY$<>CHR$ 13 OR INKEY$<>"1"
     OR INKEY$<>"2" THEN GOTO 350
410 CLS : CAT DR"????????_R"!
420 INPUT "ENTER FILENAME (not _R):";
    ' LINE B$: IF LEN B$>8 THEN GOTO
    420
430 IF LEN B$<8 THEN LET B$=B$+"_": G
    OTO 430
440 LET B$=B$+"_R": GOTO 20
450 STOP
460 IF B$="" THEN GOTO 20
470 CLS : LET A$="": OPEN #4;DDR;B$IN
480 GOSUB 650
490 FOR N=1 TO CL
500 PRINT INKEY$#4;A$;
510 IF PEEK 23689=3 THEN PRINT #0;"Pr
    ess a key to continue": PAUSE 0:
    CLS
520 NEXT N
530 CLOSE #*4: GOSUB 620: GOTO 20
540 STOP
550 IF B$="" THEN GOTO 20
560 CLS : POKE @6,1: LPRINT CHR$ 27;C
    HR$ 13: POKE @6,0: POKE @9,8: POK
    E @5,72: POKE @8,1: OPEN #4;DDR;B
    $IN
570 PRINT AT 9,1;"Printing out  '";B$
    ;"' file"
580 GOSUB 650: LET A$="": FOR N=1 TO
    CL
590 LPRINT INKEY$#4;A$;
600 NEXT N
610 CLOSE #*4: GOSUB 620: GOTO 20
620 PRINT #0;"  End of File -- Press
    a Key"
630 PAUSE 0: LET A$="": RETURN
640 REM Determine file length  courte
    sy of FORMAT Vol1 No1
650 LET STN=4: LET OFFSET=PEEK (23574
    +STN*2)+256*PEEK (23575+STN*2)
```

```
660 LET CHANADR=PEEK (23631)+256*PEEK
    (23632)+OFFSET-1
670 IF CHR$ (PEEK (CHANADR+4))<>"D" T
    HEN PRINT "not a disc file": STOP
680 LET CL=PEEK (CHANADR+31)+256*PEEK
    (CHANADR+32)+65536*PEEK (CHANADR
    +18)
690 RETURN
700 SAVE D*"README" LINE 10: VERIFY D
    *"README"
```

Save it carefully. Now you're ready to test it. Run the program, selecting option 1 which converts the Tasword file to an opentype file. Option 2 selects a directory listing only of the opentype files, since these have a "_R" extension on the end, displaying the file you have selected. Options 3 and 4 send the file to screen or printer as you wish. So you can now incorporate the file in a general program, perhaps as the instructions at the start of the game.

Now that you've got the general idea, how about using some of the facilities of BetaBasic or BetaDOS. You will need to adjust the line length to fit the CSIZE selected. Or you could adapt the program to produce an opentype file for SAM. Again, you will need MasterDOS to run this, preferably with MasterBasic, as the original SAMDOS will not cope with opentype files. With MasterDOS, you ought to be able to MOVE ASCII from PLUS D disc format to SAM format... Or you could use the code files generated by "Outwrite" or "Wordmaster" on SAM direct, adapting the program for SAM accordingly. There are all sorts of possibilities here, folks... I look forward to your contributions.

Finally, again for SAM (no, I hadn't forgotten him), a little note from Daniel Cannon of Newark, Notts, who writes that in the July issue of "Format", Nev Young said that in SAM Basic, there is a version of ON W GOTO line, line, line which is typed out as ON W: GO TO line: GO TO line: GO TO line. True (did Nev ever tell a lie), but there's a better (undocumented) way which Daniel has discovered through a typing error. This is GO TO ON W; line, line, line. This will also work with GOSUB (GOSUB ON W; line: line: line). Line can either be a line number or a LABEL. This syntax is a bit quicker than the first version, uses less memory and is a lot easier to type. Daniel has checked it with ROM versions 1.0 and 3.0, so it will almost certainly work with version 2 ROMs as well.

Daniel also mentions that he has a PRINT USING routine.....

And that's all for this month. Please keep the contributions coming to:-

John Wase,
Green Leys Cottage,
Bishampton,
Pershore,
Worcs,
WR10 2LX.

Thanks.

+ = + = + = +

UDG DESIGNER

UP TO 24 BY 16 FOR LARGE GRAPHICS

By:- Barry Cartwright.

There have been many programs written for generating user defined graphics (UDGs) but I have never seen one that allows you to build large UDGs as this one does. It is written for use with microdrive and interface 1 but works without modification on the DISCiPLE and +D. It allows you to clear any group of UDGs to blanks and to copy any UDG to any other. The main function, however, is the build.

You may build a graphic using up to six UDGs at one time. When you enter the build function you are prompted for the size of the graphic this can be any of the following 11 12 21 22 31 32 which give blocks of 1 or two in depth and 1 2 or 3 in length. As you build the graphic on the large grid a real size version is produced at the same time. Any pixel is altered by moving the cursor into the required position and pressing "k". Pressing enter will save the new UDGs above ramtop.

When entering the program the second alphabet on lines 16, 301, 900, and 950 should be done in graphics mode. The character on lines 590 and 820 is a graphic shifted 8. The program should be run in 48k mode on a +2 as two of the UDGs are used for new reserved words. You may also want to change the values on lines 730-760 to use the cursor keys on spectrum +, 128 and +2 machines. Replace "5","6","7" and "8" with CHR$ 8, CHR$ 10, CHR$ 11 and CHR$ 9.

```
  5 PAPER 7: BORDER 7: INK 0
 10 CLS : PRINT "Chose option"'"1=sav
    e"'"2=load"'"3=build"'"4=COPY"'"5
    =CLEAR"'"6=STOP"
 16 PRINT AT 19,0;"ABCDEFGHIJKLMNOPQR
    STU"'"ABCDEFGHIJKLMNOPQRSTU"
 20 LET c=INT (PEEK 23658/8)
 30 LET c=((c/2)-INT (c/2))*2
 40 IF c=0 THEN RANDOMIZE USR 4317
 50 PAUSE 0
 60 IF INKEY$="1" THEN GOTO 100
 70 IF INKEY$="2" THEN GOTO 150
 80 IF INKEY$="3" THEN GOTO 200
 81 IF INKEY$="4" THEN GOTO 900
 82 IF INKEY$="5" THEN GOTO 950
 83 IF INKEY$="6" THEN STOP
 90 GOTO 50
100 CLS : PRINT "INPUT CODE FILE NAME
    "
110 INPUT Z$
115 IF Z$="" THEN GOTO 0
120 SAVE *"M";1;Z$CODE USR "A",(21*8)
130 GOTO 0
150 CLS : PRINT "ENTER CODE FILE NAME
     OR BLANK"
155 INPUT Z$: IF Z$="" THEN GOTO 0
160 LOAD *"M";1;Z$CODE USR "A",(21*8)
170 GOTO 0
200 CLS : PRINT "ENTER SIZE OF GRAPHI
    C"
210 INPUT SIZE
220 LET L=INT (SIZE/10)
230 LET D=SIZE-L*10
240 IF D=0 OR L=0 THEN GOTO 200
250 IF D>2 OR L>3 THEN GOTO 200
260 DIM H$(D,L)
300 CLS : PRINT "LOAD GRID"
301 PRINT AT 20,0;"ABCDEFGHIJKLMNOPQR
    STU","ABCDEFGHIJKLMNOPQRSTU"
310 FOR A=1 TO D
320 FOR B=1 TO L
330 PAUSE 0
340 IF INKEY$=CHR$ 13 THEN GOTO 400
345 IF INKEY$=" " THEN LET H$(A,B)="
    ": GOTO 360
350 IF INKEY$<"A" OR INKEY$>"U" THEN
    GOTO 330
355 LET H$(A,B)=CHR$ ((PEEK 23560)+79
    )
360 IF A=1 AND B=1 THEN PRINT AT 0,0;
    "          "
365 BEEP .1,15
370 PRINT AT A,(B+28);H$(A,B)
380 NEXT B
390 NEXT A
400 PRINT  INVERSE 1; BRIGHT 1; FLASH
     1;AT 18,1;"ENTER Y IF OK"
410 PAUSE 0
420 IF NOT INKEY$="Y" THEN GOTO 200
```

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```
450 PRINT AT 18,1;"
    "
460 FOR A=175 TO (175-D*64) STEP -8
470 PLOT 0,A
480 DRAW (L*64),0
490 NEXT A
500 FOR A=0 TO (L*64) STEP 8
510 PLOT A,175
520 DRAW 0,-(D*64)
530 NEXT A
540 FOR A=0 TO D*8-1 STEP 8
550 FOR B=0 TO L*8-1 STEP 8
560 FOR C=0 TO 7
570 FOR E=0 TO 7
580 LET Z$="K"
590 IF POINT ((B+E+232),167-(A+C))=1
    THEN LET Z$="K"
600 PRINT  OVER 1;AT (A+C),(B+E);Z$
610 NEXT E
620 NEXT C
630 NEXT B
640 NEXT A
700 REM THE BUILD IT LOOP
710 LET X=0: LET Y=0: REM THE CURSOR
720 PRINT  OVER 1; FLASH 0;AT X,Y;"#"
    : PAUSE 0
725 PRINT  OVER 1;AT X,Y;"#"
730 IF INKEY$="5" THEN LET Y=Y-1: BEE
    P .1,15
740 IF INKEY$="6" THEN LET X=X+1: BEE
    P .1,15
750 IF INKEY$="7" THEN LET X=X-1: BEE
    P .1,15
760 IF INKEY$="8" THEN LET Y=Y+1: BEE
    P .1,15
770 IF X<0 THEN LET X=0
780 IF Y<0 THEN LET Y=0
790 IF X>=D*8-1 THEN LET X=D*8-1
800 IF Y>=L*8-1 THEN LET Y=L*8-1
820 IF INKEY$="K" THEN PRINT  OVER 1;
    AT X,Y;"K": BEEP .1,15
830 IF INKEY$=CHR$ 13 THEN GOTO 1000
832 LET Q=0
833 IF POINT ((Y*8)+3,(170-(X*8)))=1
    THEN LET Q=1
840 IF Q=1 THEN PLOT (232+Y),(167-X)
850 IF Q<>1 THEN PLOT  INVERSE 1;(232
    +Y),(167-X)
860 GOTO 720
900 PRINT AT 19,0;"ABCDEFGHIJKLMNOPQR
    STU"'"ABCDEFGHIJKLMNOPQRSTU"
910 INPUT "ENTER SOURCE ";A$: IF A$>"
    U" OR A$<"A" THEN GOTO 910
920 INPUT "ENTER DEST ";B$: IF B$>"U"
     OR B$<"A" THEN GOTO 920
930 FOR N=0 TO 7: POKE (USR B$+N),PEE
    K (USR A$+N): NEXT N: GOTO 0
950 PRINT AT 19,0;"ABCDEFGHIJKLMNOPQR
    STU"'""
952 INPUT "ENTER CHARS TO CLEAR ";C$:
     FOR C=1 TO LEN C$: LET A$=CHR$ C
    ODE C$(C): IF A$>"U" OR A$<"A" TH
    EN GOTO 970
960 FOR N=USR A$ TO USR A$+7: POKE N,
    0: NEXT N
970 NEXT C
980 GOTO 0
1000 REM LOAD THE UDG'S
1010 LET O=16412
1020 FOR A=1 TO D
1030 FOR B=1 TO L
1040 LET U=(PEEK 23675+PEEK 23676*256)
     +((CODE H$(A,B)-144)*8)
1050 FOR C=0 TO 7
1060 LET E=(PEEK (C*256+A*32+B+O))
1070 POKE U+C,E
1080 NEXT C
1090 NEXT B
1100 NEXT A
1110 GOTO 10
9000 ERASE "M";1;"CHAR-GEN": SAVE *"M"
     ;1;"CHAR-GEN" LINE 0: VERIFY *"M"
     ;1;"CHAR-GEN"
```

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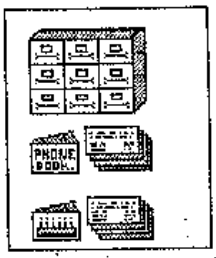

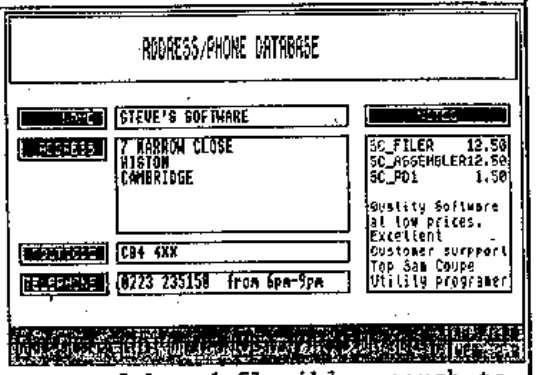

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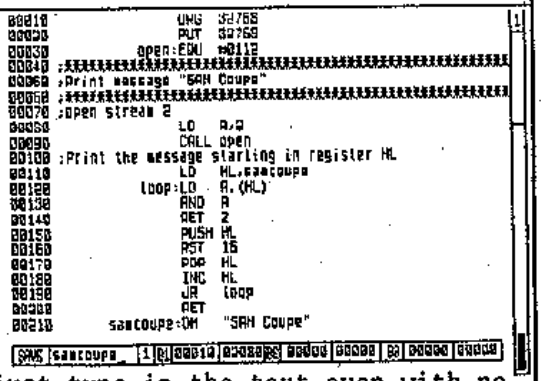

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THE COPIER

A REVIEW OF THE DISCiPLE / PLUS D UTILITY

By:- Steve O'Hare.

This utility, as the name suggests, is for making copies of your disc files, overcoming the shortcomings of the system copy.

The program arrived on tape together with an A4 sheet of instructions. Having booted up the system (GDOS 3c / G+DOS 2a or later and are allowed - it is not compatible with the new UNIDOS system) and loaded the program, it transfers to disc for future use. THE COPIER works on all double density drive systems, detecting the drive capacity automatically from the shadow RAM. Loading in 128k gives a slight gain in speed when copying and needs fewer disc swaps than in 48k mode.

The screen layout is very pleasing with everything displayed on one screen, divided into four sections. The middle two contain catalogues of the two discs involved when copying, whilst at the bottom is a window displaying messages and prompts to the user while the program is working (always nice to know what is happening!) and a reminder list of keys used for the various functions. Also shown on screen is a display of which drive is being used, how many files on the disc, a count of the number of files selected for copying, the total length of these files, and how much room is left on the destination disc. Oh, and I nearly forgot, a "READY" sign in red at the top which scrolls when the last command has finished - what more information could you ask for?

And so the program operation. First, select a source disc and put it into a drive. The directory shown on screen can be in alphabetical order or the normal disc order. Next, select a destination disc and a directory for this will also be shown. Scroll up and down and select which files you wish to copy, as few as you like, or the whole disc. Transferring the files is then automatic. If you only have one disc drive, no problem, the program will prompt you when necessary to change-over the discs. There is also the choice to overwrite a file already on the destinaton disc, or to give the "OVERWRITE?" prompt. At the end of the copying procedure the screen will inform you of how many programs have been transferred successfully and how many have failed (if, for example, there was not enough room on the disc).

The best part about the copying procedure is that should anything go wrong and a copy fails, the program does not come to a standstill or lock-up, but gives you the option to retry the disc operation or finish the copy command altogether. This is extremely useful. If you should find a sector error on the source disc, as the program allows you to ignore it and transfer all the rest.

So what files does the program copy? Just about any type, including BASIC, Machine code, Opentype, and Microdrive Files, 128k files, DISCiPLE / PLUS D / Multiface snapshots (both 48k and 128k and compressed), in fact, any file that uses the last two bytes of each sector to point to the next track and sector.

Apart from the copying, there is also a facility to change any directory names, and to delete selected files from disc (very quickly - be certain before preceeding!). The destination disc can also be swapped between drives at will (great fun to play with just to watch the changeover display on screen).

The instructions supplied are simple, with no frills, but are clear,

understandable and precise (exactly like all instructions should be). The program itself appears to be completely fool proof, is well presented and easy to use, and can be up and running in a matter of minutes. Only one slight annoyance I found was that there is no "FORMAT DISC" routine within the program. So, on finding that a disc has not yet been formatted, it is necessary to exit the program, format, and then reload the COPIER (because the DOS FORMAT will have corrupted memory). Mind you, this is really the fault of the user who should have plenty of ready-formatted discs spare!

Having used the program, I am left wondering how on earth I have managed for so long without such a utility - I certainly can't do without it now.

THE COPIER costs £6.00 (including p&p) and is available from:- Shimon Young, 21 Colchester Road, Southend-on-Sea, Essex. SS2 6HW. (Tel. 0702 331218)

BIORYTHEMS

COULD THEY FORETELL YOUR FUTURE?

By:- Adrian Russell.

It is claimed by some that our lives are controled by three well defined cycles for each of three aspects of our well being. These cycles are for our physical aspect, Intellectual aspect and emotional aspect and are known collectively as Biorythems.

The cycles start at birth and continue throughout our lives. The periods of the cycles never change and are 23 days, 33 days and 28 days for each of the three aspects mentioned above.

Critical times in our lives can be predicted by determining when any cycle crosses over from the positive to the negative side of the cycle. The crossing being in either direction. Days when there are more than one crossing are particularly bad and for any day with a triple crossing, it is recommended that you stay in bed.

I should make it clear at this point that I neither advocate nor dismiss these beliefs. But the background is given to explain the program for generating a graphic display of any persons cycles for any date in their lives.

The program can be broken down into two main sections. The inputing of dates and the generation of the graph. Each of these is further broken down as explained in the following text.

The date entry routine begins at line 160 and stores both the birthday and the target day for the required graph in the variables b$ and t$. These are both input via the common routine at line 230 that accepts a date in the form of six numeric digits for day, month and year. So this program will only work for this century. I am sure you could expand on it if needed.

When a date is requested then if nothing is entered the previous date entered is used, providing there was one. This date is then validated for correctness, firstly for length in line 260, then for being numeric in lines 270 - 290. The date is separated out into DD MM YY and then each part validated by lines 330-350. Lines 360 to 390 calculate the number of days since the 1st January 1900. Finally a correction is made for leap years at line 410 returning the value in the variable td.

This date is stored by the calling routine at lines 180 and 200 and then a cosmetic correction is made at line 210 to make the graph start two weeks before the required date.

The routine called by line 50 simply draws the graph axes and scales.

The graph drawing routine is called three times in lines 60 - 110 each time with a different value of f which is the period of the cycle. Each plot is drawn in a different colour.

The draw routine at line 600 plots 28 days for each cycle (14 days each side of the target date). Each days value being calculated by the routine at line 680 which is called from line 620.

Because of the poor colour resolution of the Spectrum there is some degree of attribute clash but this is not generally significant.

Finally don't blame me if the program predicts a really good day and you get hit by a bus in the middle of a field after jumping from a blazing airplane that had just been hijacked by terrorists fighting for an independent Isle Of Whight. Just remember, the program is for fun.

Program Listing.

```
 10 REM Biorythms by Adrian Russell.
 20 LET b$="": LET t$=""
 30 LET m$="003129313031303131303130
    1"
 40 GOSUB 160
 50 GOSUB 440
 60 LET f=23: INK 1
 70 GOSUB 600
 80 LET f=33: INK 4
 90 GOSUB 600
100 LET f=28: INK 2
110 GOSUB 600
120 INK 0
130 PAUSE 0
140 GOTO 40
150 STOP
160 REM get dates
170 LET a$="Enter your birthdate": LE
    T d$=b$: GOSUB 230
180 LET b$=i$: LET sd=td
190 LET a$="Enter target date": LET d
    $=t$: GOSUB 230
200 LET t$=i$: LET bd = td
210 LET bd=bd-14
220 RETURN
230 REM get a date
240 INPUT (a$+" "); LINE i$
250 IF NOT LEN i$ THEN LET i$=d$
260 IF LEN i$<>6 THEN GOTO 230
270 FOR n = 1 TO 6
280 IF i$(n)<"0" OR i$(n)>"9" THEN GO
    TO 230
290 NEXT n
300 LET dd=VAL i$( TO 2)
310 LET mm=VAL i$(3 TO 4)
320 LET yy=VAL i$(5 TO )
330 IF mm<1 OR mm>12 THEN GOTO 230
340 IF dd<1 THEN GOTO 230
350 IF dd> VAL m$(1+mm*2 TO 2+mm*2) T
    HEN GOTO 230
360 LET td=dd+(yy*365)+INT (yy/4)
370 FOR n=1 TO mm*2 STEP 2
380 LET td=td+VAL m$(n TO n+1)
390 NEXT n
400 LET ly=((yy/4)-INT (yy/4))*4
410 IF ly>0 AND mm>2 THEN LET td=td-1
430 RETURN
440 REM draw graph
450 CLS
460 PLOT 20,175
470 DRAW 0,-159
480 DRAW 225,0
490 PLOT 20,96
500 DRAW 225,0
510 FOR n=0 TO 28
520 PLOT 20+(225/28)*n,98+2*(n=14)
530 DRAW 0,-4-4*(n=14)
540 NEXT n
550 PRINT AT 0,0;"+ve"
560 PRINT AT 19,0;"-ve"
570 PRINT AT 20,0;"Day-10    -5    0
       5    10"
580 PRINT  INK 1;AT 21,0;"Phycical ";
     INK 2;"Intelect "; INK 4;"Emotio
    n"
590 RETURN
600 REM plot graph
610 FOR n = 0 TO 28
620 GOSUB 680
630 IF n=0 THEN PLOT 20,(21-x)*8
640 IF n>0 THEN DRAW 8,(q-x)*8
650 LET q=x
660 NEXT n
670 RETURN
680 REM calc %age
690 LET a=bd-sd+n
700 LET b=PI/2+(a/f-INT (a/f))*PI*2
710 LET x=((COS b)*18/2)+9
720 RETURN
730 REM save prog
740 SAVE OVER d1"biorythms" LINE 10
```

MACHINE CODE WITHOUT THE TEARS

Part 2.

By:- Carol Brooksbank.

This month we are going to write a short routine which will print text messages to screen or printer. The process is the same for both Spectrum and Sam, except that one address will be different.

But first, we will look at another place for storing numbers. Last month we met the filing cabinet (memory locations) and the desktop pigeonholes (registers). Well, now we have the stack, which is rather like one of those spike things you have on your desk for pushing bits of paper on.

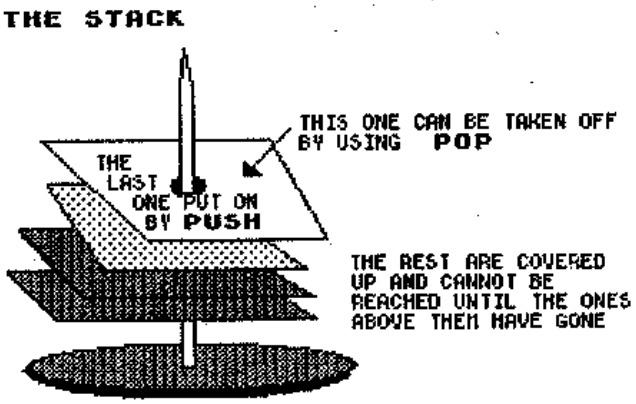


Fig.1

In fact, the opcode for storing a number on the stack is PUSH, which is always followed by the name of a double register:-

```
PUSH BC
PUSH DE
PUSH HL
```

When you want to take a number off the stack, the command is POP:-

```
POP BC
POP DE
POP HL
```

We use the stack for storing numbers for a short time when we do not want to lose track of them, but need their registers for something else. But there are one or two peculiarities. The first is, you can only POP the last number you PUSHed. Every time you PUSH a number it covers up the previous one, and if you want the second one down, you cannot get at it till you have POPped the top one. So you have to be careful to POP in reverse order of the PUSHes if you want the numbers back in their original registers. But PUSH DE, POP BC is a very quick and easy way of transferring a number from one double register to another.

The other pitfall is that the Z80 uses the stack too, independently of what you may be doing. Every time it stops what it is doing to go and execute a subroutine, or to run a machine code routine from BASIC, it PUSHes the address it has got to onto the stack. When it returns, that address must be on top. If you have left some odd address lying about on top, or POPped off the one the Z80 put there, the program will lose its way and CRASH - dazzling screen, demented disc drive - and your program lost.

So always, in every program, in every subroutine and in every execution of a loop, the number of PUSHes and POPs must match exactly. An unbalanced stack is one of the commonest causes of a crash.

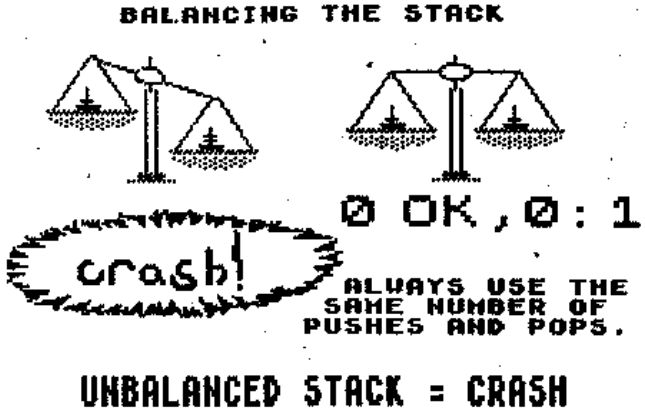
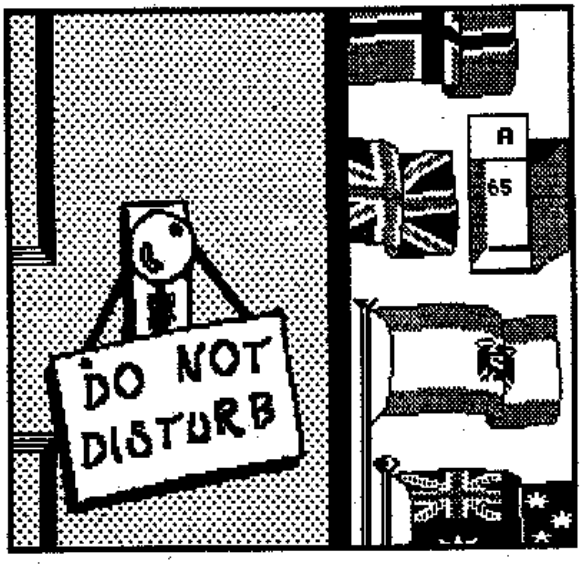


Fig.2

I said that PUSH and POP only work on double registers. So what if you want to stack the number in A? Well A has no permanent partner like all the other registers, but has an on-and-off sort of relationship with the Flags register. Flags is a special register where information about the last operation performed is stored. We shall use one of the flags, the zero flag, today. When A needs to be half of a couple it teams up with the Flags to become AF.



The A register normally lives alone, but from time to time - when it needs to be half of a pair - moves in with the FLAGS. Together they make the double register AF.

Fig.3 - THE DOUBLE REGISTER AF.

There are hardly any commands which involve AF, and the only ones we need to worry about for the moment are

```
PUSH AF
POP AF
```

Now for the short program we are going to write. Enter each of the blocks of commands in bold type into your assembler.

```
        ORG 50000
START   LD A,2
        CALL 5633 (Spectrum only)
    or
        CALL 274 (Sam only)
```

The program starts from 50000. CALL jumps to the address given and executes the commands it finds there, but will always return to the next instruction after the call when it meets a RET. This call is to a ROM routine which opens a stream for printing. If you load A with 2, printing will be to the upper screen LD A,3 will print to the printer, and LD A,1 prints to the input area at the bottom of the screen. CALL can have variants like CALL Z, which will only execute the subroutine if the zero flag is set because the result of the last sum was 0. CALL NZ will only perform the subroutine if the zero flag is not set.

CALLING

When a subroutine is CALLed, the processor goes off to execute it, but ALWAYS buys a return ticket.

If the stack is not balanced within the routine the processor may get lost on the way home - a frequent cause of a CRASH.

```
        LD HL,MESSAGE
PR_LOOP LD A,(HL)
```

Whenever you meet brackets round a double register name like this it means that the number held in the register is a memory address, and the number which interests us is the byte held at that address. We read this as "Load A with PEEK HL". It goes to the memory address held in HL, finds the value of the byte stored there, and copies it into A.

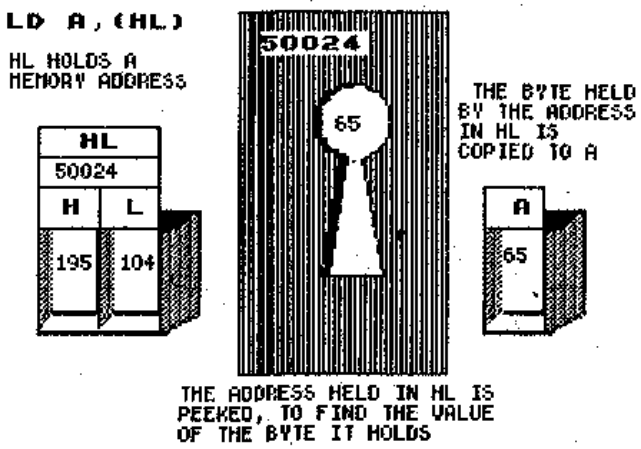


Fig.5

```
CP 255
RET Z
```

CP (ComPare) works out what would happen if you subtracted the number from the one held in the A register and sets the flags accordingly.

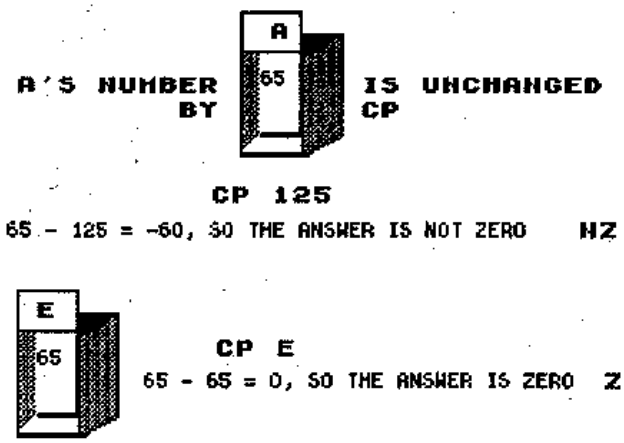


Fig.6

In this routine we want to know whether the number in the A register is 255, - the marker we shall put at the end of the message we want to print. If they are the same the result of CP's sum would be 0, so the zero flag is set and RET Z exits because we have finished the printing. If they are not the same, the answer is not 0, so the zero flag is not set and we carry on to the next instruction. We met the plain RET last month - this is a variant which checks the zero flag before deciding what to do. CP only theorizes about the sum and sets the flags to tell us what would happen, so the number in A is not affected. CP can also be used to check the number in any register against the one in A, so you can have commands like CP E, which would set the flags according to what would happen if you deducted the byte stored in E from the one stored in A. Again, the registers are unchanged.

```
PUSH HL
RST 16
```

There are 8 addresses in the ROM - the computer's operating system - which can be jumped to by the RST (ReSTart) command. The object code depends on the address being used. RST 0 would reset the computer. RST 16, the one we are using in the routine, sends the byte in the A register to the current stream.

You have to be very careful about using ROM routines in your own program. Unless you use only the RST's, or well documented entry points which the manufacturers will keep as standards, you could find that your program will not work on all versions of a computer. In this routine, we use RST 16 and the ROM routines which open a stream to a channel. These are safe to use because they will not be changed. In Sam, the address we CALL is a documented address in the jump table. Even if the routine itself is changed, SAMCO guarantee that jump table addresses will stay the same. The address we CALL for the Spectrum is fixed too. If you want to use ROM routines which are not guaranteed, you should always copy them out - write them as part of your program - and not go jumping into the ROM at some place which may be very handy in one version of a computer, but may behave differently in the next version.

```
POP HL
INC HL
```

INC (INCrement) can be used with any register or double register, and it adds 1 to the number stored there. If adding 1 would cause a single register to go above 255, it returns to 0 and the zero flag is set. If adding 1 causes a double register to go above 65535, it also returns to 0, but this time the zero flag is not affected.

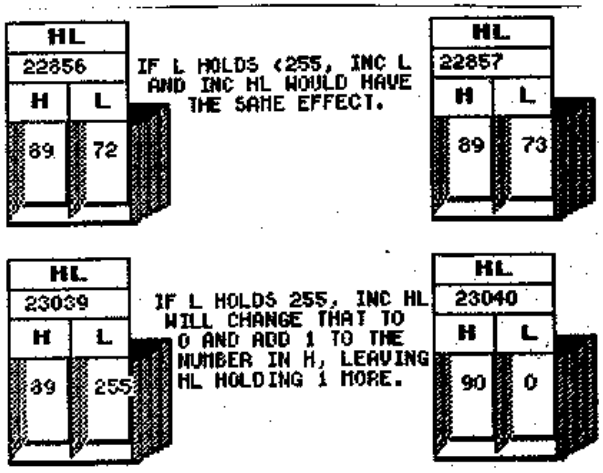


Fig.7

There is an opposite command, DEC (decrement) which works in exactly the same way except that 1 is deducted from the register. The zero flag is affected in the same way too, so beware. Many an experienced programmer has come to grief by expecting the zero flag to be set by INC or DEC a double register.

```
JR PR_LOOP
```

JR (Jump Relative) jumps over a number of bytes, missing out the ones in between. The assembler will work out the displacement - the number of bytes between where we are and where we want to jump to. But you cannot jump too far. If the displacement is 0-127, the processor will jump forward the number of bytes given, starting to count at the byte straight after its own displacement. (JR 0 is not used, of course, because you would only be telling the Z80 not to miss anything.

Fig.8

If the displacement is 128-255, the processor will jump backwards. 255 means -1, 254 -2 and so on to 128 which is -128. But it must first jump past the JR instruction and the displacement when going backwards. So JR 254 would be a disaster, because it would go back 2 bytes and land on the JR instruction again - a classic endless loop. CRASH! The range allowed is 126 bytes behind JR to 129 ahead.

Fig.9

If you need to jump further, JP (JumP) is used. JP jumps to the address given and can jump anywhere in your program.

JR and JP have variants which test the state of some of the flags, like JR Z and JP Z. These will only jump if the zero flag is set. JR NZ and JP NZ will only jump if the zero flag is not set.

JP and JR will only return to the place from which they set off if they arrive there naturally because they jumped back and worked their way forward again, or if another jump instruction sends them back.

```
MESSAGE DEFM "This is a message"
        DEFB 255
END     EQU $
LENGTH  EQU END-START
```

Finally, we have the bytes which make up our message to be printed and the marker which indicates the end of the message. DEFM (DM to some assemblers), DEFine a Message and DEFB (DB to some assemblers) DEFine a Byte are not machine code instructions but pseudo-opcodes - instructions to the assembler. These two poke into the sequence the bytes which follow them. DEFM or DM is always followed by text within inverted commas. The assembler pokes the ASCII codes for the listed characters into the program. You can change the message to anything you like. DEFB or DB pokes the bytes which are listed after it, in this case 255 as an end-of-message marker.

Next month I will explain how this little program works, but meantime if you assemble it, save the object code, CLEAR 49999, and load your code to 50000. LET A=USR 50000 will print your message.

'Here's your pocket joke book – now hand me back my tender, romantic love story'

NEV'S HELP PAGE

By:- Nev Young.

Now there is only one thing I like more than being able to help a Spectrum user and that is to help a school that uses a Spectrum. Mrs Gould is trying very hard to connect a robot to her Spectrum, ably assisted by her hubby Kevin.

Problem is NO MANUAL for the Spectrum. If you are serious about building and connecting things to the edge connector them I can recommend the "Spectrum Hardware Manual" by Adrian Dickens and published by Melbourne House (ISBN 0 86161 1152). Most certainly out of print now, but you can pester the local library. To get you going the connections on the expansion port of a 48K spectrum are:-

Lower side.	Pin.	Upper side.
A11	28	no connection
A9	27	A10
BUSACK	26	A8
ROMCS	25	RFSH
A4	24	M1
A5	23	12 volts (unsmoothed)
A6	22	12 volts
A7	21	WAIT
RESET	20	-5 volts
BUSRQ	19	WR
u	18	RD
v	17	IORQ
y	16	MREQ
VIDEO	15	HALT
0 volts	14	NMI
IORQ	13	INT
A3	12	D4
A2	11	D3
A1	10	D5
A0	9	D6
CLK	8	D2
0 volts	7	D1
0 volts	6	D0
SLOT	5	SLOT
9 volts	4	no connection
5 volts	3	D7
A12	2	A13
A14	1	A15

These are shown reading left to right while looking at the Spectrum from the rear. I hope this is enough to get you going. However you could try one of the computer shows where manuals are often for sale.

As regular readers of this page will know I try and avoid answering questions about printers. Well the pile of printer questions has just fallen over and buried the cat so I feel obliged to try "doing" a few.

But first a quickie. in issue 4/11 I made a typing error. (Most unlyke me). In my answer to Corrado Nieddu I said to include the command POKE @6,0. Thanks to those who wrote to tell me it should have been POKE @6,1. Sorry Corrado.

I won't mention names as there are some seven letters all with variations on the same problem. I did go into this at some length several months ago but here I go agian.

"My printer prints everything on one line". "My printer leaves a blank line between every line I print". "Screen dumps come out like venetian blinds".

Sound familiar. Right first find out if your printer has a switch, configuration option or whatever that will cause an automatic line feed. If it has then you can make a choice to HAVE auto line feeds or NOT.

If you don't know or can't find out type in this program and run it.

```
10 POKE @6,1
20 LPRINT "X X X X X ";CHR$ 13;
30 LPRINT " O O O O O";CHR$ 13
```

If the printout is "XOXOXOXOXO" then you have NOT, if the two lines print one below the other then you HAVE.

If you HAVE then type POKE @6,0: POKE @8,0. and resave your system file. If NOT then type POKE @6,0: POKE @8,1. and resave your system file.

If you have a Brother HR5 printer then to get a large screen dump type POKE @84,4 and reload your system file.

Some explanation of the associated variables may be useful. POKE @6 is seen very frequently by PLUS D and DISCiPLE users but many do not realise what it does. There are two values that can follow this command 0 and 1. If 1 is used than whatever you send to the printer will go to the printer directly with nothing added or taken away. This is how most, but not all, programs work as printer commands can be sent directly to the printer. The machine code used by the DOS to do this is (almost) just an OUT port,data to the printer port.

However if you use POKE @6,0 many things happen. Whatever is sent to the printer is manipulated by the system without you knowing it is happening. For example with POKE @6,1 if you type LPRINT CHR$ 250 then probably nothing will happen but code 250 will have been sent to your printer. On my printer this gives an italic 'z'. But it doesn't print until I make the printer not ready by pressing the ONLINE button. (I use an EPSON FX850) Now if I do POKE @6,0 and then type LPRINT CHR$ 250 the printer immediately prints 'IF' and spaces up by one line. The data actually sent to the printer by my PLUS D is CHR$ 73; CHR$ 70; CHR$ 13; CHR$ 10;

In this mode LPRINT commands like TAB (CHR$ 23), AT (CHR$ 22) and the print comma (CHR$ 6) are changed to do the command and NOT to send the CHR$ code. Also CHR$ 128 to CHR$ 164 are printed as block graphics, CHR$ 165 to CHR$ 255 are printed as the full KEYWORD (see chapter 27 of the Spectrum manual).

The last thing that is done is a CHR$ 13 is sent at the end of the data (providing you do not finish with a ";"). Then a number of CHR$ 10 are sent. Each CHR$ 10 will move the paper up by 1 line. The number of CHR$ 10 sent is set by POKE @8,n.

It is this very final part that causes most of the printer problems. If your printer is doing an Auto LF then you need the POKE @8,0 so that no CHR$ 10 will be sent.

Now for those who are not completley brain dead after absorbing that, a letter from R.Atkins of Reading proves the point that every solution creates a new problem thus proving the theory of cause and effect.

He writes 'Three cheers for Carol's machine code series. I have dusted off my copy of "Laser Genius" and entered the programs as microdrive files to the PLUS D. But no matter how I try I can not call these back and run them.'

You have hit an old problem with the PLUS D (and the DISCiPLE). In the days of Interface 1 a file could be saved as BASIC, CODE, DATA or PRINT. These could then be loaded back in and used by the Spectrum. When MDRV files were put on the DISCiPLE they only "emulated" the Interface 1. The result is that no matter what the file type should be it is held on disc as MDRV. If you were to decode the file you would be able to find out what type of file it should be.

Here are my suggestions for a solution to this problem: After loading your source from disc and before using the "assem" command type TAPE as a direct command. (You will have to type MDRV to go back to using disc). Now when the assembler reaches the *CLOSEOUT statement in your assembly it will prompt you to start the tape. Just in case you've missed this in the manual you sources should start with *OPENOUT "filename" and finish with *CLOSEOUT. OR without the *openout *closeout after the assem has finished type TAPE and then type CODE "filename",start address, end address, Both these methods (should) save your executable code to tape. OR just type

CALL address to run the assembled code directly.

If you get into really big machine code programs then you will want to save them to disc. If you are using GDOS then you will need a conversion program, like FCONV from S D Software, to change the MDRV file into a "real" file. If you are using UNIDOS then there is a UNIDOS version of FCONV in the utility directory.

A question that crops up time and again has been raised once more by Dan Griffin of Plymouth. He writes 'I have several programs that either multiload or save data to tape during their operation. I would like to alter the coding to make these programs completely disc based. Is there a "universal" block of code I should be looking for and if so what should I replace it with? Also what do the values in the Z80 registers represent? I can use "Pick-Poke-it" to alter them but, basically, I don't understand what I should use them for.'

Both of these queries show the same type of naïvety as "daddy, where do I come from?" and the answers can be just as complex or as evasive. Most programs are written by people in the same way as most books are written by people. If I was to pose to you the question: "I like reading detective books but only find the exposé of the murderer exciting. Is there a "universal" paragraph that I could search for...."

A rather simplistic allegory but the problem is the same. The part of the story where the detective points the finger and accuses one of the characters of the crime can be worded in an almost infinite number of ways, and can also be located on almost any page of the book. In much the same way the code to load and save can be anywhere in the program and can be written in many different ways to do, effectively, the same thing.

So no, there is no "universal" code. It will be in there but where and what it looks like is known only to the author and the few who have bothered to read all the way through.

To answer the second part of your letter about the Z80 registers. You may get some idea from the series written by Carol Brooksbank about machine code programming. Or to refer back to the allegory I used before "What do the words on the page of a book represent?" The answer to that is whatever the author wanted them to mean. No more and no less. Altering the values in the Z80 registers will have the same effect as altering the words on a page the meaning will be lost and in most cases only garbage will remain.

Looking at these registers from a snapshot is just like opening a book at any page and trying to imply a meaning to the words on that page without any reference to the rest of the book.

Well thats all for this month. Keep the letters comming. I'm sorry I can not answer queries personally, even if you do send a stamp, It's not the cost but the time. I will try and reply through these pages as best I can.

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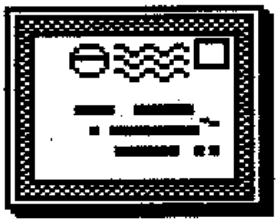

YOUR LETTERS

Dear Editor,

I have been a Spectrum user since 1986. Originally I purchased a 48k Rubber Key Speccy second hand, this was later fitted into a DK'Tronics keyboard. In 1987 I added a DISCiPLE with 5.25" twin 80 track drives. The setup has served me well but the keyboard has now started to misbehave and I can't get it repaired. Should I now get a +2 or would a SAM be the best option?

Yours sincerely, Brian Wright.

I think there are three options open to you. First, if it is the keyboard that is faulty you could try to find or even build a replacement, this would be the least-cost method but you will need luck to find a keyboard. On the subject of building a keyboard I did have an article submitted last year on such a project, however after returning it for some amendments I didn't hear from the author again (if you're out there please ring me).

Secondly you could try to buy a second hand +2, second hand because all new +2s are the dreaded +2a type and it would be very difficult to get your DISCiPLE working on one of those. Expect to pay about 80 for a bare +2, more if there is other hardware included, but don't fall for the £999 worth of software hype - if it is software you wont use it is worthless, so just bargain for the machine and they may still throw in the software.

Lastly you could as you say get a SAM, this would be the most expensive option but the one that opens the most doors to future developments. Which option you take is up to you of course. Ed.

Dear Editor,

Nice one FORMAT, Carol's new Machine Code Without Tears looks like the thing I have been waiting for since I got my SAM.

One problem though, in the example routine there is an instruction END EQU $ but my assembler wont accept this (I am using the SC_ASSEMBLER from Steve's Software). Is this a printing error?

Yours sincerely, Garry Milton.

No Garry, it is not an error, you have just discovered one of the few flaws in SC_ASSEMBLER. For some unknown reason Steve Nutting left out this useful function - which is simply a way of telling the assembler to store, under the name END, the current value of the Program Counter (where you are in memory as things get assembled). The easy way round it is to change the line to END NOP. This still stores the position in END but wastes a byte of memory.

Every other assembler I know, on both the SAM and the Spectrum, will accept the $ function and I will never understand why Steve left it out. Ed.

Dear Editor,

More, More, More... Please could you print more articles for beginners. We are not all experts you know.

Yours sincerely, Dale Potter.

Ok, Ok, I heard you the first time. And I do know what you are saying. I will try to print a few more items for the less advanced, in the meantime Carol's machine code series should keep you going. Ed.

Dear Editor,

In you editorial (FORMAT 4/12) you ask if anyone would be interested in games. I would. Oh I know you don't want to print games reviews, but how about a column with hints and tips; pokes; comparisons etc.

Yours sincerely, Roger King.

Dear Editor,

I used to look forward to the HACK ZONE articles in FORMAT and was sad when they stopped appearing. Let's have more of that sort of thing soon. Meanwhile why not have a few game reviews? I'm sure other readers would like to see some.

Yours sincerely, Tim McDonald.

Dear Editor,

As long as you don't drop the serious articles, that have made FORMAT the only Spectrum magazine worth reading, then I will welcome items on games. Also how about looking at the versions of games like Chess and Bridge that are available, the glossy mags ignore things like that.

Yours sincerely, D.G.Miller.

The subject of games has generated quite a few letters. If anyone fancies writing an article or two, like those requested above, I look forward to seeing them. Anything except reviews of arcade games will be considered. **Ed.**

Dear Editor,

Well done FORMAT, four years old and no sign of running out of steam. Keep up the good work, I look forward to the many volumes to come.

Yours sincerely. Alan Howard.

Dear Editor,

Just a short note to wish INDUG and FORMAT a very happy birthday. I have tried other mags (including the colour comics you find at the newsagents and the scrap paper of S&SC) but there is no better value than FORMAT. May you and your writers go on forever.

Yours sincerely, Sherman Minchin.

* - * - * - * - * - *

Letters may be shortened or edited to fit on these pages.

This is <u>YOUR</u> letters page so it is up to you, our readers, to fill it. Send your letters to the usual address, keep them as short as you can so we can fit in as many as possible.

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QUARTERS

A GAME FOR TWO ON SAM

By:- Daniel Cannon.

Following the Editor's request for "Mind Games" I thought this would be a good excuse to test out SAM Basic. This is the SAM version of a game which I first saw a while back on the BBC micro.

It has been written using SAM's structured Basic commands (DO LOOP, IF THEN ELSE, DEFPROC) so it is fairly easy to follow. One thing may interest hardened Spectrum Basic programmers; there is not a GOTO or GOSUB to be found (What? How can you program without those!) and I've tried to put each section, however small, into it's own procedure. This helped in debugging a lot - you just write each subroutine and test it by supplying the entry varibles and seeing what the result is. But on with the game.

Quarters is a 2 player game, the computer just acts as board and rule keeper. Each player starts with some tiles (64 as the program is set up). The square shape tiles each have a randomly chosen colour on each side. To score points the player must place their tile on a board in a position which allows the edges of tile to match with the edges of the tile(s) around it. A point is given for each edge which matches, and a bonus of 2 points are given if the tile fits completely in it's surroundings. No points are lost if you place the tile in a position which doesn't match it's neighbour, but you are loosing valuable points for that turn.

The players each take turns until their tiles run out. The winner is the person with most points. The end score is displayed in the show_endbit procedure. This is not essential to the game's running, but looks pretty all the same. To set the number of tiles to begin the game with, alter pltile and p2tile which are set up in the set_vars procedure.

The control keys are: Cursor keys to move the place which the tile will go (this is highlighted in inverse colours), T to turn the tile through 90 degrees clockwise (you can turn it as many times as you like) and P to pass your go if you can't find a place to put it. Use Return to position the tile.

Perhaps someone would like to have a go at getting the computer to act as one of the players.

```
  10 REM Quarters
  20 REM By Daniel Cannon
  30 set_udgs: DO :ask_name:set_vars:
     set_scr: DO :pick_col:res_cur: D
     O :player_move whogo:check_tile:
      LOOP UNTIL okplace: IF NOT pass
      THEN put_tile:calc_score:add_sc
     ore whogo
  40 take_tile whogo:swap_player: LOO
     P UNTIL NOT pltile AND NOT p2til
     e: show_endbit: LOOP UNTIL NOT I
     NSTR("yY",key$): CLS #: PRINT "B
     ye!": STOP
1000 DEF PROC set_scr: LOCAL a
1010 MODE 4: CSIZE 8,8: CLS #: title:
      PRINT #1;"CURSORS, T turn, P pa
     ss, RET put": PEN 1: FOR a=-1 TO
      143 STEP 16: PLOT 7,a: DRAW 241
     ,0: PLOT 7,a+1: DRAW 241,0: NEXT
      a: FOR a=7 TO 247 STEP 16: PLOT
      a,0: DRAW 0,144: PLOT a+1,0: DR
     AW 0,144: NEXT a: GRAB block$,8,
     15,16,16: PEN 6: PRINT AT 0,3;"T
     "; AT 0,24;"T"; AT 1,3;"S"; AT 1
     ,24;"S"'plname$; TAB 32-LEN p2na
     me$;p2name$: PEN 7: END PROC
1500 DEF PROC set_udgs: LOCAL a
1510 LOCAL b
1520 MODE 4: CSIZE 8,8: CLS #: FOR a=
     UDG CHR$ 144 TO UDG CHR$ 147+7:
     READ b: POKE a,b: NEXT a: END PR
     OC : DATA 255,127,63,31,15,7,3,1
     ,255,254,252,248,240,224,192,128
     ,1,3,7,15,31,63,127,255,128,192,
```

```
    224,240,248,252,254,255
2000 DEF PROC set_vars: DIM board$(9,
     15,4): LET p1tile=63,p2tile=p1ti
     le,p1scr=0,p2scr=0,whogo=0,keypr
     ess$=CHR$ 8+CHR$ 9+CHR$ 10+CHR$
     11+CHR$ 13+"pPtT",leave$=CHR$ 13
     +"pP": END PROC
2500 DEF PROC ask_name: LOCAL a$
2510 title: PRINT '' PAPER 2; PEN 7;
     TAB 7;"By Daniel Cannon.",: INPU
     T #2''''"Hello player 1, please e
     nter"''"your name: "; LINE p1name
     $: LET p1name$=p1name$+("Player
     1" AND p1name$=""): INPUT #2''"H
     i there player 2, what's your  n
     ame? "; LINE p2name$: LET p2name
     $=p2name$+("Player 2" AND p2name
     $=""): PRINT ''"Press any key to
      play...": DO : LOOP UNTIL INKEY
     $="": PAUSE : END PROC
3000 DEF PROC pr_tile x,y: PRINT AT x
     ,y; PAPER col4; PEN col1;CHR$ 14
     4; PAPER col2;CHR$ 145; AT x+1,y
     ; PAPER col4; PEN col3;CHR$ 146;
      PAPER col2;CHR$ 147: END PROC
3500 DEF PROC pr_cur x,y: PRINT AT x,
     y; INVERSE 1; OVER 1;"  "; AT x+
     1,y;"  ": END PROC
4000 DEF PROC pr_block x,y: PUT y*8,1
     75-x*8,block$: END PROC
4500 DEF PROC turn_tile: LOCAL a
4510 LET a=col4,col4=col3,col3=col2,c
     ol2=col1,col1=a: END PROC
5000 DEF PROC show_score: PRINT PEN 6
     ; AT 0,5;p1tile;" "; AT 0,26;p2t
     ile;" "; AT 1,5;p1scr; AT 1,26;p
     2scr: END PROC
5500 DEF PROC pick_col: LET col1=RND(
     3)+1,col2=RND(3)+1,col3=RND(3)+1
     ,col4=RND(3)+1: END PROC
6000 DEF PROC res_cur: LET curx=1,cur
     y=1: END PROC
6500 DEF PROC player_move p: show_sco
     re: DO :pr_tile 0,30*p:pr_block
     0,30*(1-p):pr_cur 2*curx+2,2*cur
     y-1: DO : GET key$: LOOP UNTIL I
     NSTR(keypress$,key$):pr_cur 2*cu
     rx+2,2*cury-1: LET cury=cury-(cu
     ry>1 AND key$=CHR$ 8)+(cury<15 A
     ND key$=CHR$ 9),curx=curx+(curx<
     9 AND key$=CHR$ 10)-(curx>1 AND
     key$=CHR$ 11): IF INSTR("tT",key
     $) THEN turn_tile
6510 LOOP UNTIL INSTR(leave$,key$): L
     ET pass=0+(1 AND INSTR("pP",key$
     ))
6520 END PROC
7000 DEF PROC put_tile:pr_tile 2+curx
     *2,2*cury-1: LET board$(curx,cur
     y,1)=CHR$ col1,board$(curx,cury,
     2)=CHR$ col2,board$(curx,cury,3)
     =CHR$ col3,board$(curx,cury,4)=C
     HR$ col4: END PROC
7500 DEF PROC take_tile p: LET p1tile
     =p1tile-NOT p,p2tile=p2tile-p:sh
     ow_score: END PROC
8000 DEF PROC check_tile: LET okplace
     =pass: IF CODE board$(curx,cury,
     1)=32 THEN LET okplace=1
8010 IF pass=1 THEN BEEP .025,-10: EL
     SE IF okplace=1 THEN BEEP .025,1
     0: ELSE BEEP .25,-11
8020 END PROC
8500 DEF PROC calc_score: LOCAL a
8510 LET score=0: IF curx>1 THEN IF b
     oard$(curx-1,cury,3)=CHR$ col1 T
     HEN LET score=score+1
8520 IF cury<15 THEN IF board$(curx,c
     ury+1,4)=CHR$ col2 THEN LET scor
     e=score+1
8530 IF curx<9 THEN IF board$(curx+1,
     cury,1)=CHR$ col3 THEN LET score
     =score+1
8540 IF cury>1 THEN IF board$(curx,cu
     ry-1,2)=CHR$ col4 THEN LET score
     =score+1
8550 IF score=4 THEN FOR a=1 TO 3: ZA
     P : NEXT a: LET score=6
8560 END PROC
9000 DEF PROC add_score p: IF NOT sco
     re THEN END PROC
9010 DO : LET p1scr=p1scr+NOT p: LET
     p2scr=p2scr+p:show_score:sound_f
     x 1+score: LET score=score-1: LO
     OP UNTIL NOT score: END PROC
9500 DEF PROC sound_fx pitch: SOUND 0
     ,255;8,0;16,pitch;20,1;28,1: FOR
      a=0 TO 255 STEP 5: SOUND 8,a: N
     EXT a: SOUND 0,0;8,0;16,0;20,0;2
     8,0: END PROC
10000 DEF PROC swap_player: LET whogo=
     1-whogo: END PROC
10500 DEF PROC title: CLS : CSIZE 8,16
     : PRINT TAB 11; PAPER 5; PEN 0;"
     QUARTERS!"'': CSIZE 8,8: END PRO
     C
11000 DEF PROC show_endbit: LOCAL a
11010 LOCAL b
11020 LOCAL c
11030 LOCAL a$
11040 FOR a=0 TO 15: PALETTE a,0: NEXT
      a: PAPER 1: CLS : RESTORE 11090
     : FOR a=1 TO 4: READ b,c: CIRCLE
      b,c,2: FILL PEN 2+(a=2 OR a=3);
     b,c: PLOT b+1,c+1: NEXT a: GRAB
     a$,0,175,16,16: CLS : PLOT 20,9:
```

```
 DRAW TO 236,9: DRAW 10,10,2: DR
AW TO 246,155: DRAW -10,10,2: DR
AW TO 20,165: DRAW -10,-10,2: DR
AW TO 10,19: DRAW 10,-10,2: FILL
 USING a$;0,175: FILL PEN 0;20,2
0: PAPER 0
11050 FOR a=1 TO 20 STEP 2: CIRCLE PEN
 4;50,120,a: CIRCLE PEN 5;100,14
0,a: CIRCLE PEN 6;120,30,a: CIRC
LE PEN 7;200,100,a: NEXT a: CSIZ
E 8,16: PRINT AT 5,11; PEN 10;"G
AME OVER!": CSIZE 8,8: IF plscr>
p2scr THEN LET name$=plname$,sco
re=plscr,lead=plscr-p2scr: ELSE
LET name$=p2name$,score=p2scr,le
ad=p2scr-plscr
11060 IF plscr<>p2scr THEN LET a$="Wel
l done "+name$+", for achieving
a winning score of "+STR$ score+
", beating the opposition by "+S
TR$ lead+" point"+("s" AND lead<
>1)+".": ELSE LET a$="It's a dra
w!"
11070 LET a$=a$+" If you want another
game press the Y key, otherwise
press any other key to leave the
 program. ": PALETTE : PALETTE 2
,32,48: PALETTE 3,48,32: PALETTE
 15,0: DO : FOR a=1 TO LEN a$: P
RINT AT 13,29; PEN 15;a$(a): FOR
 b=1 TO 8: PLOT PEN 0;232,72: DR
AW PEN 8; OVER 1;0,-8: PAUSE 1:
SCROLL 1,1,24,71,216,8: LET key$
=INKEY$: IF key$="" THEN NEXT b:
 NEXT a: LOOP
11080 POP : CLS #: END PROC
11090 DATA 4,171,12,171,4,163,12,163
```

I hope that readers enjoy playing the game, and anyone confused over the use of DEF PROC and its associate commands which are only glossed over in the manual can now see how to place them in their own programs.

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RE-INKING (2)

A SECOND LOOK AT RE-INKING PRINTER RIBBONS

By:- John Wase.

Readers might remember that being impecunious, I recycle my ribbons, using proprietary reinking devices. I wrote an article about the perils and pitfalls of this some little time ago in FORMAT Vol 4 No 3, November 1990, p21. I fear I might have given the wrong impression then, so I'll put the record straight once and for all. If you use your printer regularly (and if you don't, it's a bit of a waste, isn't it), then, unless you're a total mechanical goon, it's not too difficult to reink ribbons, and it can save you a lot of money.

In my original article, I compared two products; "Caspells' Ribbon Refresh" and the "Maxiprint Ribbon Re-inker", and readers will recall that I concluded Ribbon Refresh was better for the very casual user with only a few ribbons per year (it gave print not as black and didn't last as long as the "Maxiprint", but was cheaper and was easier to use). I also mentioned that Caspells were fighting back, and now had a new, blacker, non-aerosol, ozone-friendly product, and that I would report on it in due course. At the "Which?" Computer Show, Caspells passed me a continer of their new product, called "Re-ink" to try. Here's my considered opinion.

In my previous article, I went through all the desirable and undesirable properies of inks and how they affect ribbons. Of my dot matrix printers, the most critical is my Epson LQ400 - 24-pin with a nylon multistrike ribbon of much finer fabric than the 9-pin variety. So, at the risk of my precious print head, this was the ribbon cartridge I used for testing.

The can looks superficially like an aerosol with a clear plastic lid. Take it off, and the aerosol-like white cylinder and jet are actually a built-in pump, operated with the finger. On the side of the can are clear instructions, showing little pictures of various common ribbon cartridges, together with a recommendation for each of the "number of pumps" it should receive. Essentially, as with "Ribbon refresh", you select a large table, a roll of tissue, polygloves if you're at all fussy, spread newspaper on the table, carefully open up the ribbon, then carefully spray with the required number of pumps. Wind in the bit of ribbon outside, make sure that it's inked, stick the lid on and leave for 24 hours.

The pump was easy to operate. I would have preferred a tube (WD40 style), as in "Ribbon Refresh", but in fact, at the recommended three inch distance, very little of the ink went overboard. It's fairly odiferous - not stinky, but smells strongly of butanol (one of the alcohols, if you're a chemist), and I would recommend that your room be well-ventilated. Don't use naked flames, either or you could have fun...

So, we stick the cassette all together again. Clip the inkey lid on with a sigh of relief. The stuff's pretty difficult to shift from my fingers: perhaps I ought to have worn the polygloves after all.... Wind the ribbon on.... Click, clack.... Why won't the darn thing wind? Open it all up again. Trouble traced to a sort of springy thingy at the far end of the cassette, which keeps the ribbon tension up. It's coated with an inky layer, rather like the mud left after a flood, from which the butanol has evaporated and which actually seems to promote a very high degree of friction. Curious. In fact, I don't like it very much. There should be

sufficient silicone oil in the brew to lubricate things. What price my precious print-head now?

So, adjust the spring tension. Ah, that's better. Clip the lid on with a sigh of relief, wind the ribbon on - good; it's working; let's leave it for 24 hours....

The next night, I got back from the University bearing the usual pile of papers, reports and letters. Spotted the ribbon later that night. So upstairs we went, stuffed it in the printer (hope it wasn't in the rather warm kitchen next to the Rayburn for too long - it gets rather warm there, and I might have dried it up). I needn't have worried. The final effect was smeary and blotchy in the extreme. Far too much ink, not very well distributed. Well, O.K., let's see what time does...

Three days later, and I've now used the ribbon for some time. The print head is fine, the smudges have almost all gone away, and the thing is now printing rather more evenly, though still not nearly as well as with "Maxiprint".

So the final verdict? "Re-ink" is a pound or two dearer than the original "Ribbon Refresh". It has all its disadvantages in that you must disembowel your ribbon cassette and spray things all over the place. The final result is, however, much better. Don't put too much on, though, like I did! At around the twelve quid mark, you don't need to spray many ribbons before break-even point is reached. It seems to be lasting very well, better than "Ribon Refresh", though I found it not nearly as good as "Maxiprint", which gives the ultimate in longlasting deep black reinking - although at a price. I would therefore recommend "Re-ink" to the average amateur who is not dumping enormous numbers of screens with large black areas to his printer, and who uses a relatively small number of ribbons a year.

RE-INK, from Caspell Computer Services, Poole, Dorset. Telephone:- 0202 666155

THOUGHT SPOT.

By:- Jeremy Cook.

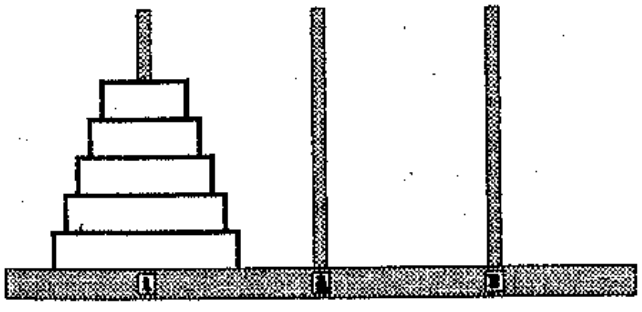
Oh! Hello. You're early; I wasn't expecting you for at least another couple of pages. I'm not quite ready, but since you're all here...

First you will want a small thing that shouldn't tax your brains too much. This paragraph has a usually vital thing missing. Nothing is actually wrong, but it is unusual. Study all words and symbols in it scrupulously and you should find what I'm talking about. It is so amazingly obvious that you will probably work it out in about an hour!

Secondly you will perhaps like a prize puzzle, which some of you will notice is a repeat of puzzle no.5. I must apologise for all this repetition, especially to those who entered first time round, but as I have said before, I received nothing for this puzzle, due largely to Royal Mail inc. ltd. plc. & co. If I now mention ONE YEARS FREE SUBSCRIPTION to FORMAT! in capital letters you may remember that this is the prize awarded to the winner of this particular puzzle.

Thirdly I am pleased to announce that something about previous prize puzzles comes after these simple problems.

PRIZE PUZZLE NO.10: HANOI'S TOWERS



The diagram shows the start position of this problem, in which the tower on the left peg has to be moved to the right peg by moving the discs one at a time. But you have to make sure, if a disc is to be placed on another, that the disc below is larger.

Before you can write a program for any of these puzzles, you have to have a strategy for solving it. Perhaps the easiest way is to think how you would do it by hand, but this is not necessarily the best way. But for any problem it is usually best to think of ways to break it down into smaller problems that can be solved more easily and then slotted back together.

Also when you write a program it is always a good idea to find different ways to do things. Invariably the first attempts give you an understanding of the problem, and subsequent attempts improve the program considerably, because of the better understanding.

Send your program in by 1st November 1991 to:-

Jeremy Cook (Thought Spot),
6, Burgoyne Road,
Sunbury-on-Thames,
Middlesex,
TW16 7PW.

(Note that discs and cassettes will only be returned if an SAE is enclosed).

Even if you can't do all of any particular puzzle, I am still interested in what you have done and what ideas you have.

You reach a junction; visible exits are left, right, up and down. Looking down you see an intellectual challenge, right leads to unexplored areas of FORMAT. What now?

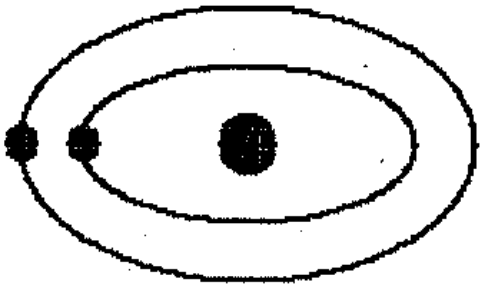
HEADS AND TAILS

Replace the last letter of the word on the left of the brackets and the first letter of the word on the right with another letter. The letter used should make two new English words. Place the letter in the brackets so that when all the letters have been found, a word reads down. Find that word.

BEAR ( ) GOWN
DATE ( ) IMPS
TWIN ( ) CAPE
QUIZ ( ) FEAR
POSH ( ) WARN
LOOK ( ) PACK

ROUND TRIP

In this star system, the two planets orbit the sun clockwise, with the outer planet making one revolution every 9 years and the inner planet revolving once every 3 years. Can you work out when the planets and sun will next form a straight line?



POINT TO POINT

Using the letters A, B, C, D and E, complete the square by placing one letter at each point. No horizontal, vertical, or diagonal line can contain any letter more than once.

. . . . .
D . . . .
. . . . .
C . . . .
. . . B A

ON AVERAGE

An aeroplane going from one airport to another maintains an average speed of 252 miles per hour, but on the return to the first airport over exactly the same distance, it only does an avergage of 180 miles per hour. What was the average speed over the whole journey, there and back. (Hint- it's not 216).

Going already? Hey! Come back; I've only just started. Oh well. For those of you still here, thank you for coming. A couple a people have sent me some puzzles which I might well include at some point. If you think you have an interesting puzzle which you would like to share with us, send it in and I may even publish the good ones. Don't forget the prize puzzles though; keep 'em coming. Do you need more time, more help, more anything? If you have something to say, then drop me a line. Byf orn ow.

- * - * - * - * -

SOLUTIONS TO AUGUST'S PUZZLES

Diamound:- I seem to have made a mistake (yes, another one - sorry) while copying the sums from paper to computer. One digit in one of the numbers is wrong. Answer next month!

All Sports:- The numbers after the names give their ranks in golf, swimming and tennis: Al Farley 123, Brad Enfield 231 and Chuck Dillon 312.

Baltimore Transdeletion:- (-A) resting, stinger; (-S) granite, tearing; (-T) erasing, regains; (-R) seating, teasing; (-I) garnets, strange; (-N) gaiters, seagirt; (-G) nastier, retinas; (-E) ratings, staring. There are of course other words at some stages, but these are slightly less obscure

- * - * - * - * -

PRIZE PUZZLE Nos.6 & 7
WINNERS AND THINGS

You'll be pleased to hear that I have at last got around to writing about previous prize puzzles. Apologies for the delay, but this extra helping should set the record a bit straighter.

Puzzle 6: Sliding Blocks.

For this puzzle I received just

three entries, from Alan Cox, D.A. Lorner and J.Saunders. Unfortunately, D.A.Lorner's program does not actually solve the puzzle, but displays previously worked out moves (although a small number of moves, and graphically very good). J.Saunders only sent in his partial solution, which tries to solve it by moving the smallest number into the space. It needs more work done on it, and is a very interesting method if it could be made to work.

Thus it would seem that the prize defaults to Alan, not undeservedly for not only is his program capable of solving 3x3, 4x4 and 5x5 blocks, but it is also very interesting to watch. The only thing wrong is the large number of moves it takes. So I shall award the prize to Alan Cox. I wont however, print his program or give an idea of how it works because they are too long.

Puzzle 7: Power Cubes.

I had three entries, from D.J.Munro, Alan Cox and D.A.Lorner. All three attempted to find all the orientations of the cubes, with varying degrees of success. Another thing they all did was to keep the cubes stacked in one order, but in setting the problem I said nothing to suggest this (in my opinion). However, this is trivial (in the sense that it is not important to the fundamentals of the problem, but it would increase the power got from the cubes twentyfour-fold!) so I'll ignore it.

D.J.Munro's program has four FOR-NEXT loops for the 24 orientations of each cube, the orientations being held in an array. The number of checks is neatly reduced by looking at all four sides of the stack in turn, finding the highest place that two colours match, thus jumping to an outer NEXT rather than continuing with the inside one. The only problem with this program is that it does not take into account rotations of the stack, and hence duplicates the solutions (of which there are just six). I think the repetition comes from using all 24 orientations on the top cube, and by selecting just six of the orientations (ie. one for each face being on top), I think the duplicates would be removed.

Alan Cox's program has six orientations for each cube (ie. one for each face of the cube on top). Each time it checks to see if the right colours are showing, and if so it rotates the bottom three cubes (top stays the same to stop rotation of stack). If during these rotations there are all four colours on all four sides, the solution is printed. What I like about this program is that it cuts down the checking that needs to be done, especially compared to D.J. Munro's program. And also the way it checks to see if the right colours are there; it enlists the help of a mathematical theorem which says that a number can be written as a unique product of its prime factors, and vice versa. The upshot is that if you assign a prime number to each colour, eg. 1,2,3,5 then you have all four colours if, and only if, the product of the colours you're checking is 30.

D.A.Lorner's program had a few bits of data missing, but when I put these in, all six solutions were found, more quickly than the other programs, and again graphically very good: a second program even gave a three-dimensional view of the stack, and rotated it! The program works by providing for each cube all the ways that four faces can show on the stack, with the first side of the stack kept constant. To choose the colours of the constant side of the stack, you need to find on each cube the colours that appears twice, but not on opposite sides of the cube. Then choose from this the four colours for the side. This is valid because one or other of the faces with the chosen colour has to be showing. The program takes these groups of four faces and just goes through all the arrangements of them.

It was a very difficult choice, and I took all three programs into account, ignoring the few mistakes, since they were the only entries. I

finally decided that the prize would go to the method I liked best, which was that of D.A. Lorner.

Having decided the winner I then pruned the program of graphics, since they wouldn't transfer to FORMAT easily, added a bit of program to reduce the amount of data, and the result, shown below, is the essence of D.A.Lorner's solution. The data could be reduced still further, but I couldn't be bothered. How well this program would cope with a different set of cubes I am not sure; all the cubes would have to have a colour not on opposite faces, and you would have to be able to make a constant side.

Some explanation of the program: the single letter in the DATA at lines 140-170 is the colour that goes on the constant side of the stack; the four sets of three letters in the DATA are the colours that can be on the other sides of the stack, and the program above the DATA also reverses these, making eight sets of four colours for each cube; because the third cube has green on opposite faces there are only six individual sets of four colours - this is reflected in line 250, although a more general check would be better; the test procedure checks for non repeated colours to the specified depth. If all that is a bit difficult to understand I recommend that you make a set of cubes. I found OXO cubes useful for this!

```
 10 LET tote=1
 20 DIM c$(4,8,4)
 30 FOR c=1 TO 4
 40 READ LINE f$
 50 LET p=1
 60 FOR g=1 TO 4
 70 READ LINE g$
 80 LET c$(c,p)=f$+g$
 90 IF g$(1)=g$(3) THEN LET p=p+1: GO
    TO 120
100 LET c$(c,p+1)=f$+g$(3)+g$(2)+g$(1
    )
110 LET p=p+2
120 NEXT g
130 NEXT c
140 DATA b,bgr,brg,rgy,rry
150 DATA g,gry,gyr,brr,byr
160 DATA y,ybr,yrb,gbg,grg
170 DATA r,rbg,rgb,bby,bgy
180
190 FOR a=1 TO 8
200 PRINT AT 0,1;"A ";c$(1,a)
210 FOR b=1 TO 8
220 PRINT AT 1,1;"B ";c$(2,b)
230 test 2,c$(1,a)+c$(2,b)
240 IF fail THEN GOTO 340
250 FOR c=1 TO 6
260 PRINT AT 2,1;"C ";c$(3,c)
270 test 3,c$(1,a)+c$(2,b)+c$(3,c)
280 IF fail THEN GOTO 330
290 FOR d=1 TO 8
300 PRINT AT 3,1;"D ";c$(4,d)
310 test 4,c$(1,a)+c$(2,b)+c$(3,c)+c$
    (4,d)
320 NEXT d
330 NEXT c
340 NEXT b
350 NEXT a
360
400 DEF PROC test n,s$
410 LET fail=0
420 FOR e=2 TO 4
430 FOR f=0 TO n-1
440 FOR g=f+1 TO n-1
450 IF g=f THEN GOTO 470
460 IF s$(4*f+e)=s$(4*g+e) THEN LET f
    ail=1: GOTO 510
470 NEXT g
480 NEXT f
490 NEXT e
500 IF n=4 THEN cube s$
510 END PROC
520
600 DEF PROC cube s$
610 FOR r=0 TO 15
620 LET p=INSTR("br.g.y",s$(r+1))
630 PRINT AT 9+r DIV 4,4+r MOD 4; PAP
    ER p;" "
640 NEXT r
650 PRINT AT 9,2;"A"'" B"'" C"'"  D"
660 PRINT AT 17,1; PEN 12;"press any
    key"'" to continue"
670 PRINT AT 7,5; PEN 14;tote
680 PAUSE : PRINT AT 17,1,,,
690 LET tote=tote+1
700 END PROC
```

An interesting point to note about this puzzle is that all you need to know about the cubes is what the pairs of opposite faces are eg. for the first cube:- BG, BR and RY. I've written a program using this fact that solves the problem in about 10 seconds (the above program takes about a minute).

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